Translation of Paragraphs [0006] - [0013] of Japanese Unexamined Patent Application H10-296650

[0006] The aim of the present invention is to provide a plus bit which has outstanding wear resistance and a long lifespan.

[0007]
[Means of Resolving the Problems] The abovementioned aim is achieved by employing cemented carbide as the material for the tip end of the plus bit. The WC particles of cemented carbide which have a degree of hardness of 2000 or more measured by Vickers hardness are dispersed in Co, Ni or Cr which constitute a binder, and it is possible to obtain outstanding wear resistance due to the effect of WC.

[0008] The main purpose of cemented carbide is to improve the wear resistance of the tip ends of tools and dies or the like, which constitutes its normal application, and therefore chemical components are selected in which hardness is seriously taken into consideration. However, it is necessary with plus bits to take account of both a high degree of hardness and also the prevention of the appearance of cracks, and therefore normal cemented carbide in which serious consideration has been given to wear resistance is inadequate. Accordingly, the present invention takes a novel approach to the chemical composition and the particle size of the WC, and cemented carbide which has the following characteristics is used. The chemical composition is as follows: the total amount of Co, Ni, Cr included is set at 15-25%, and the remaining part is WC. Furthermore, the particle size of the WC is set at no more than 5 μm. The amount of Co, Ni, Cr etc. included as binder is set at 15-25% because above 25% the wear resistance is lowered due to a decrease in hardness, and wear is generated early on; below 15% the toughness becomes inadequate and cracks appear at the

tip end part when screws are being tightened. Furthermore, the particle size of the WC is set at no more than 5 μm because when the particle size is greater than 5 μm the toughness is markedly reduced and cracks appear in the tip end part of the plus bit when screws are being tightened.

[0009] The cemented carbide described above is employed as the material for the tip end part of the plus bit, but brazing is employed for the joint with the body part when it is used in the tip end part. At this time, one of either the joining surface of the cemented carbide side of the tip end part 1 or the joining surface of the body part 2 is made into a projecting V-shape, and the other joining surface is made into a recessed V-shape, as shown in Figure 1. By adopting this kind of shape, it is possible to achieve a firm joint, and it is possible to prevent detachment of the joining part during use.

[0010]
[Mode of Embodiment of the Invention] The present invention will be described with reference to the exemplary embodiment below. Using the present invention, a plus bit of the shape shown in Figure 1 was produced. The total amount of Co, Ni, Cr included in the chemical composition of the cemented carbide used was varied at 5, 15, 25 and 35%, and the remaining part was WC. Furthermore, the particle size of the WC was 1 μm. In addition to this, a plus bit made of medium carbon steel constituting a conventional product was prepared.

[0011] The test of these five types of plus bits involved continuous tightening of 5000 screws, and the state of the progression of wear and the appearance of cracks was investigated. The wear was evaluated by counting the number of screws tightened until effective turning was no longer possible, because as wear of the

tip end part of the plus bit progresses the fixing of the plus bit into the head part of the screw becomes inadequate and ineffective turning is likely to occur. The conditions at this time were as follows: plasterboard was used as the fastening material and the screws were tightened manually at a rate of 3 screws/second. Figure 2 shows the test results. The wear of the conventional product progressed significantly due to tightening 500 screws, effective turning was not possible and it had reached its lifespan. Cracks appeared in the tip end part of the product containing a total amount of Co, Ni, Cr of %5 due to tightening 30 screws, and normal screw tightening was not possible. Normal screw tightening was possible with the products containing 15 and 25%, even after tightening 5000 screws. With the product containing 35%, wear progressed and it reached its lifespan at 1200 screws.

[0012] The same continuous screw tightening test was conducted for 6 types of plus bits in which the total amount of Co, Ni, Cr included was 15%, and the WC particle size was set to 0.5, 1, 3, 5, 7 and 9 µm. Figure 3 shows the test results. Even after tightening 5000 screws no cracks appeared in the tip end parts of the products with a WC particle size of 0.5, 1, 3 and 5 µm, but cracks appeared due to 120 screws at 7 µm and 50 screws at 9 µm.

[0013]
[Effect of the Invention] According to the present invention, it is possible to provide a plus bit for a screw driving apparatus which has outstanding wear resistance and toughness, and a long lifespan.